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EVOLUTION OF CRICKET SONGS

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The "simple" chirping song of the cricket outside one's window at night, although often admired, is not usually fully appreciated by the listener for actual complexity, its evolution over hundreds of millions of years, nor for the important role it plays in speciation. All of these topics were discussed by Dr. Daniel Otte, curator in the Department of Entomology at the Academy, in a lively, and at times, humorous, talk that incorporated computer-generated audio, actual song recordings of crickets from Dr. Otte's many travels worldwide and various cricket "props".

Due to an excellent fossil record, the evolution of crickets can be traced at least to the late Permian, over 250 million years ago. Unlike their sister group, the katydids, which show tremendous morphological variation, crickets have remained relatively homogeneous. This applies in part to their mechanism of sound production as well. Whereas in crickets and katydids, a single mechanism is utilized (file and scraper on each wing, with the "ears" on the front legs), in grasshoppers at least 12 different sound producing mechanisms have been identified. That sound production in crickets is ancient can be demonstrated by the overall similarity of the wing in fossil and recent species, even as far back as the earliest known forms. This conservatism does not extend, though, to the "song" itself, which shows an amazing diversity among the 3500 extant, described species (probably only one tenth of the actual diversity!).

As in most other sound producing insects, it is the males which sing to attract females, and the females which choose the males. Because sound in crickets is produced by opening and closing the wings, a true continuous sound cannot be produced, but a single tooth strike, multiplied in a series, forms a pulse, and these pulses can appear like a true continuum to the human ear. The pulse forms the basic building block of the song, and Dr. Otte has traced the evolutionary pathways of cricket songs through modifications of the pulses. For example, a train of pulses produces a trill, short gaps between series of pulses form chirps and mixing of these functions produce more complex songs. Most instructive was Dr. Otte's computer generation of audio pulses, which clearly illustrated how cricket song complexity can be constructed over evolutionary time through dropping, coupling or tightening pulses, with different pathways often yielding similar songs.

In nature, though, the story is even more complex, as illustrated by audio tapes recorded in the field. Males must find a "sound window" among other conspecific males, and their environment may be full of other singing species of Orthoptera, other insects and even frogs. Songs of a species may vary throughout the day, and decedant species may diverge in evolutionary time depending on the makeup of other cricket species in their area. And the habitat may include more than cricket singing, such as katydids, cicadas, and even frogs, although this chorus of species poses far more difficulty for the human researcher than for any specific female cricket!

The talk by Dr. Otte was preceded by the presentation of the Calvert Awards for student excellence. Among notes of entomological interest, Howard Boyd reported a massive aggregation of nesting plasterer bees (Colletidae: *Colletes thoracicus* (Smith) in burrows on a sandy slope in Lebanon State Forest in the New Jersey pine barrens. Mr. Boyd counted 550+ active bee burrows in an area of 6 x 18 meters. Over 40 members and their guests were present.

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